

TECHNICAL REFERENCE

WIRE TERMINATION

Systematic wiring in a panel board requires a layout of properly selected Terminal Blocks. In the normal course, it would be appropriate to assign one wire per clamping unit of a Terminal Block thus, simplifying the task of identification of the circuit.

The Screw Clamp Terminal Blocks can accommodate wires one size higher than the rated cross section. It must be noted that they can also take two wires one size smaller than the rated cross section.

If, however, two wires are connected to one clamping unit of a screw clamp Terminal Block, care must be taken to ensure that the total current assigned to the two wires does not exceed the continuous rating of the Terminal Block.

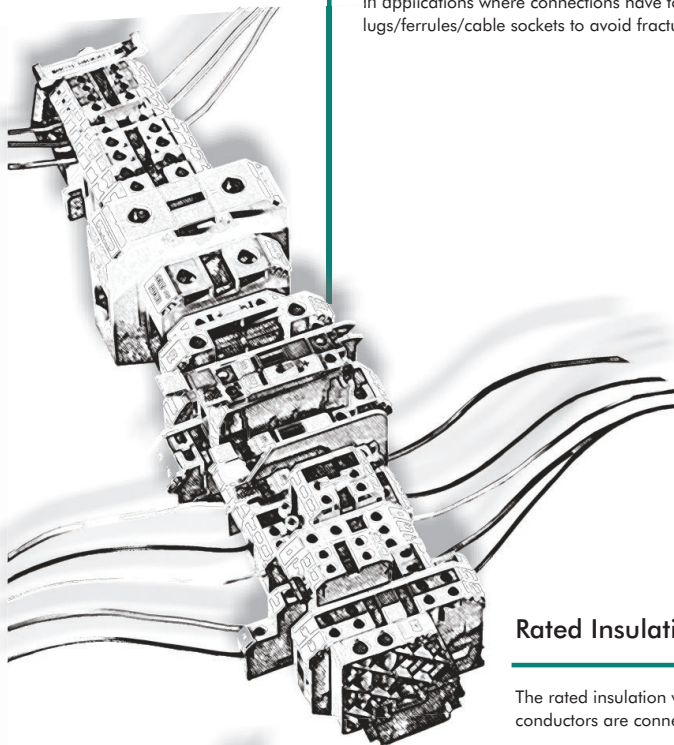
For 'Screwless' Spring Clamp Terminal Blocks, special care must be taken that only one wire must be connected per clamping unit.

The relevant standard, IEC 60947-7-1, section 4.3.5 states that for Terminal Blocks with a rated cross section from 0.2 sq. mm to 35 sq. mm. (both inclusive), the manufacturer shall specify the range and number of the rated cross section. The conductor can be rigid (solid or multi strands) or flexible (fine strands), these values can be found in product related technical data.

Connectwell feed through Terminal Blocks are designed to allow copper wires to be connected without any special preparations such as soldering the individual strands of wire or using cable lugs / ferrules. However, wires requiring special preparation can also be used in Connectwell Terminal Blocks, as per IEC 60947-7-1.

For connecting aluminium wires, special care must be taken while stripping the insulation from the wires. It is strictly recommended to use ferrules and lugs while connecting flexible aluminium wires. Once the wire has been stripped of its insulation to the recommended length, it should be coated with acid and alkaline free Vaseline and screwed into the terminal immediately. This procedure must be followed each time that an aluminium wire is to be disconnected and reconnected.

In applications where connections have to be changed frequently, it is recommended to use lugs/ferrules/cable sockets to avoid fracturing of individual wires.



Rated Insulation Voltage with two wires/conductors

The rated insulation voltage of the Terminal Blocks does not change if the wires / conductors are connected correctly.

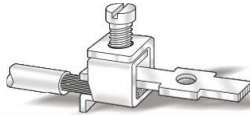
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WIRE CONNECTION METHOD

Screw Clamp Connection

The 'Screw Clamp Connection' is the most popular method of wire termination. It offers distinct advantages over the other wire termination methods:



- Suitable for all cross-sections and types of wires
- Wires can be connected without any special preparation
- Provides vibration resistant connection
- Simple connection and disconnection of wires with the aid of an ordinary screw driver (Fig.1)
- The cold forged rolled threaded screws provide high tightening torque.

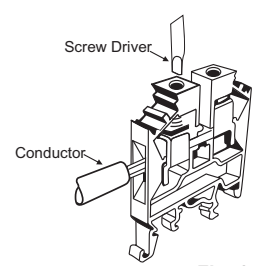


Fig. 1
Screw Clamp Operation

The steel clamping screw produces high contact force while the steel clamping yoke transmits this force by pressing the conductor against the current bar. The conducting medium within a Terminal Block is its current bar, which is made from electrolytic copper or 63 / 37 brass and tin plated. The tin plating on the current bar ensures excellent continuous contact and provides good protection against corrosion. Even the best electrical conductor materials are worthless without the required contact force to press the connected wire to the contact surface on the current bar. It is because of this that the clamping yokes and screws are made of steel. The steel parts are zinc plated and additionally chromate passivated in order to achieve the highest degree of corrosion resistance.

When the clamping screw is tightened, the clamping yoke gets pulled upwards, pressing the wire against the current bar. The clamping yoke and current bar are serrated. The serrations of the current bar cut through the oxide skin of the wire on tightening, thereby providing many contact lines. The serrations of the clamping yoke improve the gripping of the wire. When the wire is tightened, the clamping pressure pulls the top threaded surfaces of the yoke exerting extra high locking action on the clamping screw. (Fig. 2)

Changes caused by temperature variations, if any, are effectively equalised by the elasticity of steel, providing excellent vibration resistance.

Large pressure areas on the current bar and the clamping yoke prevent notching, which otherwise could lead to possible wire fracture. The clamping yokes come in different sizes and shapes to accommodate wires of different cross sections. A flat clamping area ensures safe gripping of wires of smaller cross sections. The flange / tail of the clamping yokes prevents false entry of the wires underneath the yokes.

The following characteristics make the Screw Clamp Connection user friendly, versatile and sturdy:

- Strong contact force which makes it absolutely gas tight
- Very low contact resistance
- Excellent vibration proof protection preventing loosening of screws
- Reliable electrical and mechanical connection
- Ease of handling

Cable Lug Connection

This method of wire termination is preferred for connections that are subject to very severe vibrations. The wire is crimped to a ring/fork type and is screwed on to the flat current bar in the Terminal Block.

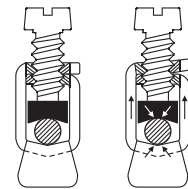
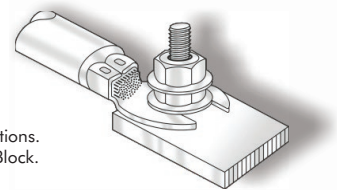


Fig. 2
Wire / Conductor Retention

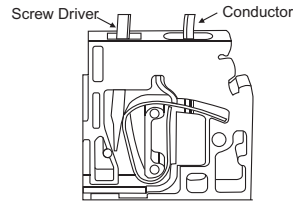
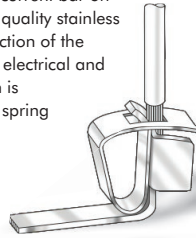
TERMINAL BLOCKS

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WIRE CONNECTION METHOD

Spring Clamp Technology

The more recently introduced Screwless Spring Clamp connection is as versatile as the screw clamp connection. In this type of a connection, the wire is held against the electrolytic copper current bar directly by a pre stressed spring clamp. The spring is operated by using a screw driver to provide an access to the wire through the opening in the spring clamp. The inserted wire gets clamped on to the current bar on the removal of the screw driver. The high quality stainless steel spring clamp ensures a good connection of the wire with minimal contact resistance. The electrical and mechanical quality of the wire connection is maintained by the high quality rust proof spring clamp. Only one wire per clamp must be terminated.



Screwless Spring Clamp Actuation

The following are the characteristics of Spring Clamp Connection:

- Easy to operate, versatile and vibration proof
- Minimal contact resistance because of a gas tight connection is made possible by the high quality stainless steel spring clamp
- Fail proof / safe, maintenance free connection
- The surface treated (tin plated) electrolytic copper current bar ensures oxidation free contact

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WIRE TIGHTENING

The design of the Connectwell Screw Clamps / Cable Lug system ensures vibration proof positive connection wires at the recommended torque values. However, Connectwell Terminal Blocks can withstand torque levels in excess of the recommended torque values. The Terminal Block clamping parts when tightened within the torque range ensure optimum performance as given below:

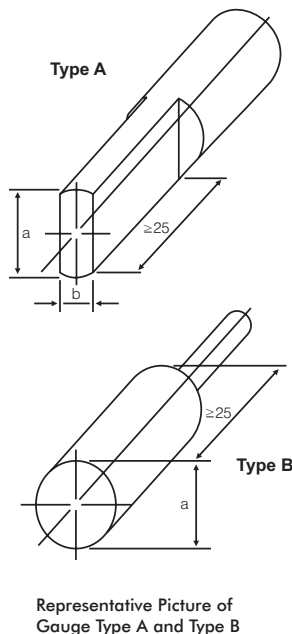
- The voltage drop (contact resistance) is well below the specified limits
- The wire gets clamped perfectly to form a gas tight connection
- The clamping yoke does not get damaged mechanically. The tightening torque according to IEC 60947-7-1 table 4, is the safe limit of the torque which guarantees the successful clamping of the connected wire.

Connectwell Terminal Blocks tightening torque data is given in the respective product pages.

All Connectwell Terminal Blocks are designed to function with rated wire sizes as per their respective AWG (American Wire Gauge) or Metric size/system. The Terminal Blocks are tested for Gauge Insertion as per VDE 0660.

Tightening Torque for Screw Clamp Terminal Blocks

Terminal Blocks	Thread Size of Fastener	Recommended Torque Value
CTS2.5UN/CPT(M)/CPT5	M 2.5	0.4 Nm
CTS2.5(M)/CMST1/CMST2	M 2.6	0.4 Nm
CTS2.5/CMT4/CMB4/CDL4U/ODL4U/ CGT4U/CTS4UN/CTS4SC/CSTS3/CSFL4U/CSDL4U/CKT4U/CPT7.5/DDFL4U/ DDFL4U(E)/DDFL4U(E)LR/CMC1-2/CMC2-2	M 3	0.5 Nm
CTS6/CTS6SC/CTS6U/CSFL6U/CENC4	M 3.5	0.8 Nm
CTS10/10U/CTS16/16U/CSTSN4/B4/CDTTS/CTS10SC/CGT10U/DDPT/CDTTU/CSTSN4U/STH4	M 4	1.2 Nm
CTS25U/CSTS5/N5/N5(1.5)/RN5/N5U/CENC16	M 5	2.0 Nm
CTS35/CTS35U/CENC35/CGT35U/CSTSN6U	M 6.0	2.0 Nm
CTS35L/35LS/CSTSRN6/CSTSN6	M 6.0	2.8 Nm
CTS70L/70LS/CTS95L/95LS	M10.0	10.0 Nm



Conductor cross-sections and Gauges

Conductor Cross-section							
Flexible (sq.mm)	Rigid (solid or stranded) (sq.mm)	Gauge Type A			Gauge Type B		Permissible deviation for a and b
		Marking	Diameter a (mm)	Width b (mm)	Marking	Diameter a (mm)	
1.5	1.5	A1	2.4	1.5	B1	1.9	0 / -0.05
2.5	2.5	A2	2.8	2.0	B2	2.4	0 / -0.05
2.5	4	A3	2.8	2.4	B3	2.7	0 / -0.05
4	6	A4	3.6	3.1	B4	3.5	0 / -0.06
6	10	A5	4.3	4.0	B5	4.4	0 / -0.06
10	16	A6	5.4	5.1	B6	5.3	0 / -0.06
16	25	A7	7.1	6.3	B7	6.9	0 / -0.07
25	35	A8	8.3	7.8	B8	8.2	0 / -0.07
35	50	A9	10.2	9.2	B9	10.0	0 / -0.07
50	70	A10	12.3	11.0	B10	12.0	0 / -0.08
70	95	A11	14.2	13.1	B11	14.0	0 / -0.08
95	120	A12	16.2	15.1	B12	16.0	0 / -0.08
120	150	A13	18.2	17.0	B13	18.0	0 / -0.08
150	185	A14	20.2	19.0	B14	20.0	0 / -0.08
185	240	A15	22.2	21.0	B15	22.0	0 / -0.09
240	300	A16	26.5	24.0	B16	26.0	0 / -0.09



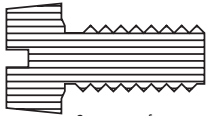
TERMINAL BLOCKS

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TERMINAL BLOCK MATERIAL

Connectwell Terminal Blocks are made of carefully selected materials, insulating materials, clamping and conducting metals which are subject to strict quality control as demanded by the most stringent international standards.

Clamping Screws

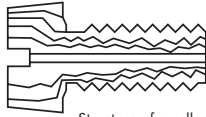


Structure of a turned Screw

One of the most important parts of the terminal block is its screw. The quality of the connection depends mainly on the quality of the screw. The screw must not get damaged, should withstand a higher torque than what is stipulated in its specification. The screw should not, even at the highest stress weld with the metal of the main thread.

Connectwell Terminal Blocks employ cold forged rolled threaded steel screws. In such screws the material is compressed and therefore strengthened. Whereas, when turned screws are cut, the material from between the threads is removed. Because of this and the stress concentration on the neck of the screw, the turned screw is considerably weaker on strength.

The screws are zinc plated and chromate passivated for a good galvanic surface.



Structure of a rolled Screw

Clamping yoke

Clamping yokes in carefully selected grades of steel ensure high torque performance necessary for gas tight connections. The clamping components (both screws and clamping yokes) are electroplated with zinc and passivated by an additional coat of chromate. The Zinc provides a cathodic protection to the steel. Therefore the effect of protection against corrosion is still retained even when the plating is partially damaged by scratches or pores.

The clamping components of some of Connectwells Terminal Blocks are made of copper alloys. Such components are electroplated with either nickel or tin to ensure oxidation free performance.

Current carrying / Conducting components

The current carrying/conducting components / current bars are made of electrolytic grade copper or copper alloy to ensure very low contact resistance. The components are electroplated with tin / nickel to provide an oxidation free contact.

Insulating Material

All the live parts in Terminal Blocks are totally shrouded to minimize the risk of accidental contact in High Grade Melamine or in Engineering Thermoplastic Polyamide 6.6 Housing.

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TERMINAL BLOCK MATERIAL

Polyamide 6.6

Engineering Thermoplastic Polyamide 6.6 has excellent electrical, mechanical and chemical characteristics, even at temperature as high as 105°C. This insulating material has high mechanical strength - it is unbreakable. Its resistance to tracking is similar to Melamine. The Polyamide 6.6 moulded housing absorbs humidity from its surroundings. However, it does not crystallise water in the plastic itself as is the case in thermosetting plastic. The H₂O groups combine within the molecular structure.

Thus moulded plastic housing becomes fracture proof and unbreakable even in sub zero temperature conditions.

Polyamide 6.6 is difficult to ignite, self-extinguishing, burns only as long as there is a supporting flame and is rated V2 according to UL 94. It has excellent resistance to micro organisms, bacteria, enzymes and termites. Good ageing resistance and insensitivity to ultra violet light makes it suitable for tropical and open air applications. Polyamide 6.6 has excellent resistance to fuels, oils, fats and most common solvents like aliphatic and aromatic carbohydrates, ketons and alcohols.

Typical properties of insulation material

Property	Unit	Thermoset High Grade Melamine	Engineering Thermoplastic Polyamide 6.6
Specific Gravity	-	1.5	1.2 - 1.15
Upper Temperature Limit	°C	130	105
Lower Temperature Limit	°C	- 55	- 50
Volume Resistivity	Ohm cm	10 ¹¹	10 ¹²
Surface Resistivity	Ohm	10 ¹⁰	10 ¹⁰
Dielectric Strength	KV/cm	100	400
Tropical Resistance	-	Good	Good
Flammability	Grade	V0	V2 / V0 #
Flexibility	-	-	Excellent

V0 available on request

CE Marking

The CE marking is, in particular, an indication that the products comply with the essential requirements of applicable directives and that the products have been subject to a conformity assessment procedure provided for in the directives. CE marking ensures free trading within Europe. Connectwell terminal blocks are CE marked and the products comply to Low Voltage Directive, 73/23/EEC, Including amendments by the CE marking directive, 93/68/EEC

At Connectwell the Product Development cycle, production & assembly of components and supply are all controlled by an ISO 9001:2008 Quality Management System.

Connectwell Products not only fulfill Customers needs and requirements of standards and specifications but also surpass the same.